	Application No.	Applicant(s)
Notice of Allowability	10/608,083	BRUNO ET AL.
	Examiner	Art Unit	
	Srirama Channavajjala	2166	

-- *The MAILING DATE of this communication appears on the cover sheet with the correspondence address*--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☐ This communication is responsive to *4/10/07*.

2. ☒ The allowed claim(s) is/are *1-5,8-10,12-14,16-27,30-32,34-36 and 38-61*.

3. ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a) ☐ All   b) ☐ Some*   c) ☐ None   of the:

        1. ☐ Certified copies of the priority documents have been received.

        2. ☐ Certified copies of the priority documents have been received in Application No. _____ .

        3. ☐ Copies of the certified copies of the priority documents have been received in this national stage application from the

            International Bureau (PCT Rule 17.2(a)).

    * Certified copies not received: _____ .

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application. **THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.**

4. ☐ A SUBSTITUTE OATH OR DECLARATION must be submitted. Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL PATENT APPLICATION (PTO-152) which gives reason(s) why the oath or declaration is deficient.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.

    (a) ☐ including changes required by the Notice of Draftsperson's Patent Drawing Review (PTO-948) attached

        1) ☐ hereto or 2) ☐ to Paper No./Mail Date _____ .

    (b) ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of

        Paper No./Mail Date _____ .

    Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☒ Notice of References Cited (PTO-892)

2. ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)

3. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____

4. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material

5. ☐ Notice of Informal Patent Application

6. ☒ Interview Summary (PTO-413), Paper No./Mail Date *4/30/2007* .

7. ☒ Examiner's Amendment/Comment

8. ☒ Examiner's Statement of Reasons for Allowance

9. ☐ Other _____ .

DETAILED ACTION

1.   Claims 1-5,8-10,12-14,16-27,30-32,34-36,38-61 are allowed.

2.   Claims 1-5,8-9,11-12,16-17,20-21,23-27,30-31,33-34,38-39,42-43,45-46,49-54,57-61 have been amended 4/10/2007.

3.   Claims 1,23,45-46,54 have been amended [12/11/2006].

4.   A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 11 December 2006 has been entered, and a non-final office action was mailed on 1/10/2007.

5.   Examiner acknowledges applicant's amendment filed on 7/25/2006.

Drawings

6.   The Drawings filed on 6/27/2003 are <u>acceptable</u> for examination purpose.

Information Disclosure Statement

7.   The information disclosure statement filed on 8/29/2003 is in compliance with the provisions of 37 CFR 1.97, and has been considered and a copy was enclosed with previous Office Action mailed on 1/25/2006.

Double Patenting

8.   In view of applicant's filing "*terminal disclaimer*" on 7/25/2006, the non

statutory double patent rejection as set forth in the previous office action is

hereby withdrawn.

Interview:

9.   Applicant's Attorney Sung T Kim, , Reg.No. 45,398 is thanked for the

telephone interview on 30 April 2007. During that telephone interview Sung T

Kim granted authorization to *amend claims 1,3,5,12-14,16-17,20-21,23-27,30-*

32,34-36,38-46,51,54-61, and cancell claims 11,33.

EXAMINER'S AMENDMENT

10.   An examiner's amendment to the record appears below. Should the

changes and/or additions be unacceptable to applicant, an amendment may be

filed as provided by 37 CFR 1.312. To ensure consideration of such an

amendment, it MUST be submitted no later than the payment of the issue fee.

        Authorization for this examiner's amendment was given in a telephone

interview with Applicant's Attorney Sung T Kim, Reg.No. 45,398 on 30 April

2007.

The application has been amended as follows:

In the Claims:

1.   (Currently amended) A computer implemented method for approximating

a number of tuples returned by a database query to optimize queries on a

computerized database that comprises a set of predicates that each reference a

set of database tables, the method comprising the steps of:

a)   determining whether a first estimated selectivity value of the query

is stored and returning the stored first estimated selectivity value to approximate

the number of tuples returned by the query;

b)   if a first estimated selectivity value of the query is not stored,

expressing the query as an input ~~query~~ selectivity value;

c)   determining if the query is separable based on properties of the

input selectivity value;

d)   if the query is separable:

            separating the input ~~query~~ selectivity value to form a product

        of query selectivity factors;

    recursively determining a selectivity value for each query selectivity factor;

            combining the selectivity values for each query selectivity

        factor to determine a second estimated selectivity value of the

        query;

e)   if the query is not separable:

            atomically decomposing the input ~~query~~ selectivity value to

        form a product that comprises a conditional selectivity expression,

wherein the atomically decomposing step is repeated for one or
more atomic decompositions of the input selectivity value to
produce a plurality of alternative products that comprise
corresponding conditional selectivity expressions;

for each of the plurality of alternative products, matching a
corresponding conditional selectivity expression with stored
statistics to obtain statistics that can estimate a selectivity value of
the conditional selectivity expression by:

compiling a set of candidate statistics that can be
used to estimate the selectivity value of the conditional
selectivity expression;

selecting candidate statistics to estimate the
selectivity value of the conditional selectivity expression
based on a selection criteria; and

using the statistics to obtain an estimated selectivity
value of the conditional selectivity expression; and

combining the estimated selectivity values of the conditional
selectivity expressions corresponding to each alternative product to
determine a third estimated selectivity value of the query;

f)   storing in memory either the second or third estimated selectivity
value of the query based on whether the query is separable.

2.   (Previously presented) The method of claim 1 comprising the step of

multiplying the second or third estimated selectivity value of the query by a

Cartesian product of the tables referenced by the predicates to obtain a

cardinality of the query.

3.   (Currently amended) The method of claim 1 wherein the step of

separating the input ~~query~~ selectivity value to form a product of query selectivity

factors is performed by separating the predicates that reference different sets of

database tables to form a product of query selectivity factors that reference

different sets of database tables.

4.   (Previously presented) The method of claim 1 wherein each product

formed in step e) further comprises a query selectivity factor and wherein a

selectivity value for each query selectivity factor is recursively determined.

5.   (Currently amended) The method of claim 1 wherein steps c) – f[[e]]) are

recursively performed until a non-separable query selectivity that can only be

decomposed into a single conditional selectivity expression results.

6.   Canceled.

7.   Canceled.

8.   (Previously presented) The method of claim 1 comprising the step of

associating an error with the third estimated selectivity value that is based on an

accuracy with which the statistic matched with a conditional selectivity expression

can estimate the selectivity of the conditional selectivity expression.

9.   (Previously presented) The method of claim 8 comprising the step of

combining the error associated with each conditional selectivity expression to

obtain an estimated error for the third estimated selectivity value for the query.

10.   (Original) The method of claim 1 wherein the stored statistics comprise

histograms on results of previously executed query expressions.

11.   Canceled.

12.   (Currently amended) The method of claim 1̶4̶ wherein the selection criteria

for a candidate statistic is determined by computing a number of independence

assumptions that are made when the candidate is used to estimate the selectivity

value of the conditional selectivity expression and the selection criteria is to

select the candidate that results in the least number of independence

assumptions.

13.   (Currently amended) The method of claim 1̶4̶ wherein the selection criteria

for a candidate statistic is determined by comparing the candidate statistic with a

base statistic over the same column as the candidate statistic and assigning a

difference value to the candidate statistic based on a level of difference between

the candidate statistic and the base statistic.

14.   (Currently amended) The method of claim 1~~4~~ wherein the step of

compiling a set of candidate statistics is performed by including statistics that are

on results of queries having the same tables referenced by the conditional

selectivity expression or a subset of the tables referenced by the conditional

selectivity expression and the same predicates over the tables referenced in the

conditional selectivity expression or a subset of the predicates over the tables

referenced in the conditional selectivity expressions.

15.   Canceled.

16.   (Currently amended) The method of claim 1 wherein the step of atomically

decomposing the input ~~query~~ selectivity value is done by exhausting every

alternative way of atomically decomposing the query.

17.   (Currently amended) The method of claim 1 wherein the steps of

atomically decomposing the input ~~query~~ selectivity value to form a products that

comprises a conditional selectivity expressions is performed based on an

optimizer search strategy.

18.   (Original) The method of claim 1 wherein the query is disjunctive and

comprising the step of transforming the disjunctive predicates into conjunctive

predicates by performing a De Morgan transformation on the disjunctive query.

19.   (Original) The method of claim 1 wherein the query comprises a

GROUP BY predicate over a grouping column and wherein the query is

transformed prior to performance of the method steps to return a number of

distinct values in the grouping column.

20.   (Currently amended) The method of claim 19 wherein the step of

atomically decomposing the input ~~query~~ selectivity value is performed by

considering decompositions that are induced by coalescing grouping.

21.   (Currently amended) The method of claim 19 wherein the step of

atomically decomposing the input ~~query~~ selectivity value is performed by

considering decompositions that are induced by invariant grouping.

22.   (Original) The method of claim 1 wherein the stored statistics comprise

histograms built over computed columns in a query result.

23.   (Currently amended) For use with a database system, a computer

readable storage medium having computer executable instructions stored

thereon for performing method steps to approximate a number of tuples returned

by a database query to optimize queries on the database system that comprises

a set of predicates that each reference a set of database tables, the method

comprising the steps of:

a)   determining whether a first estimated selectivity value of the query

is stored and returning the stored first estimated selectivity value to approximate

the number of tuples returned by the query;

b)   if a first estimated selectivity value of the query is not stored,

expressing the query as an input ~~query~~ selectivity value;

c)   determining if the query is separable based on properties of the

input selectivity value;

d)   if the query is separable:

separating the input ~~query~~ selectivity value to form a product

of query selectivity factors;

recursively determining a selectivity value for each query

selectivity factor;

combining the selectivity values for each query selectivity

factor to determine a second estimated selectivity value of the

query;

e)   if the query is not separable:

atomically decomposing the input ~~query~~ selectivity value to

form a product that comprises a conditional selectivity expression,

wherein the atomically decomposing step is repeated for one or

more atomic decompositions of the input selectivity value to

produce a plurality of alternative products that comprise

corresponding conditional selectivity expressions;

for each of the plurality of alternative products, matching a

corresponding conditional selectivity expression with stored

statistics to obtain statistics that can estimate a selectivity value of

the conditional selectivity expression <u>by:</u>

<u>compiling a set of candidate statistics that can be</u>

<u>used to estimate the selectivity value of the conditional</u>

<u>selectivity expression;</u>

<u>selecting candidate statistics to estimate the</u>

<u>selectivity value of the conditional selectivity expression</u>

<u>based on a selection criteria;</u> and

using the statistics to obtain an estimated selectivity

value of the conditional selectivity expression; and

combining the estimated selectivity values of the conditional

selectivity expressions corresponding to each alternative product to

determine a third estimated selectivity value of the query; and

f)   storing in memory either the second or third estimated selectivity

value of the query based on whether the query is separable.

24.   (Currently amended) The computer readable storage medium of claim 23

comprising the step of multiplying the second or third estimated selectivity value

of the query by a Cartesian product of the tables referenced by the predicates to

obtain a cardinality of the query.

25.   (Currently amended) The computer readable storage medium of claim 23

wherein the step of separating input query-selectivity value to form a product of

query selectivity factors is performed by separating the predicates that reference

different sets of database tables to form a product of query selectivity factors that

reference different sets of database tables.

26.   (Currently amended) The computer readable storage medium of claim 23

wherein each product formed in step e) further comprises a query selectivity

factor and wherein a selectivity value for each query selectivity factor is

recursively determined.

27.   (Currently amended) The computer readable storage medium of claim 23

wherein steps c) – f[[e]]) are recursively performed until a non-separable query

selectivity that can only be decomposed into a single conditional selectivity

expression results.

28.   Canceled.

29.   Canceled.

30.   (Currently amended) The computer readable storage medium of claim 23 comprising the step of associating an error with the third estimated selectivity value that is based on an accuracy with which the statistic matched with a conditional selectivity expression can estimate the selectivity of the conditional selectivity expression.

31.   (Currently amended) The computer readable storage medium of claim 30 comprising the step of combining the error associated with each conditional selectivity expression to obtain an estimated error for the third estimated selectivity value for the query.

32.   (Currently amended) The computer readable storage medium of claim 23 wherein the stored statistics comprise histograms on results of previously executed query expressions.

33.   Canceled.

34.   (Currently amended) The computer readable storage medium of claim 3323 wherein the selection criteria for a candidate statistic is determined by computing a number of independence assumptions that are made when the candidate is used to estimate the selectivity value of the conditional selectivity

expression and the selection criteria is to select the candidate that results in the

least number of independence assumptions.

35.   (Currently amended) The computer readable storage medium of claim

~~33~~23 wherein the selection criteria for a candidate statistic is determined by

comparing the candidate statistic with a base statistic over the same column as

the candidate statistic and assigning a difference value to the candidate statistic

based on a level of difference between the candidate statistic and the base

statistic.

36.   (Currently amended) The computer readable storage medium of claim

~~33~~23 wherein the step of compiling a set of candidate statistics is performed by

including statistics that are on results of queries having the same tables

referenced by the conditional selectivity expression or a subset of the tables

referenced by the conditional selectivity expression and the same predicates

over the tables referenced in the conditional selectivity expression or a subset of

the predicates over the tables referenced in the conditional selectivity

expressions.

37.   Canceled.

38.   (Currently amended) The computer readable storage medium of claim 23

wherein the step of atomically decomposing the input query selectivity value is

done by exhausting every alternative way of atomically decomposing the query.

39.   (Currently amended) The computer readable storage medium of claim 23

wherein the steps of atomically decomposing the input query-selectivity value to

form a product that comprises a conditional selectivity expressions is performed

based on an optimizer search strategy.

40.   (Currently amended) The computer readable storage medium of claim 23

wherein the query is disjunctive and comprising the step of transforming the

disjunctive predicates into conjunctive predicates by performing a De Morgan

transformation on the disjunctive query.

41.   (Currently amended) The computer readable storage medium of claim 23

wherein the query comprises a GROUP BY predicate over a grouping column

and wherein the query is transformed prior to performance of the method steps to

return a number of distinct values in the grouping column.

42.   (Currently amended) The computer readable storage medium of claim 41

wherein the step of atomically decomposing the input query-selectivity value is

performed by considering decompositions that are induced by coalescing

grouping.

43.   (Currently amended) The <u>computer readable storage medium</u> <s>method</s> of

claim 41 wherein the step of atomically decomposing the <u>input</u> <s>query</s>-selectivity

<u>value</u> is performed by considering decompositions that are induced by invariant

grouping.

44.   (Currently amended) The computer readable <u>storage</u> medium of claim 23

wherein the stored statistics comprise histograms built over computed columns in

a query result.

45.   (Currently amended) A computer system comprising one or more

processors and memory for approximating a number of tuples returned by a

database query to optimize queries on a computerized database that comprises

a set of predicates that each reference a set of database tables comprising:

        a)   means for determining whether a first estimated selectivity value of

the query is stored and means for returning the stored first estimated selectivity

value to approximate the number of tuples returned by the query;

        b)   means for expressing the query as a<u>n input</u> <s>query</s>-selectivity <u>value</u>

if a first estimated selectivity value of the query is not stored;

        c)   means for determining if the query is separable<u> based on properties</u>

<u>of the input selectivity value</u>;

        d)   means for separating the <u>input</u> <s>query</s>-selectivity <u>value</u> to form a

product of query selectivity factors if the query is separable, further comprising:

means for recursively determining a selectivity value for

each query selectivity factor;

means for combining the selectivity values for each query

selectivity factor to determine a second estimated selectivity value

of the query;

e)   means for atomically decomposing the input ~~query~~ selectivity value

to form a product that comprises a conditional selectivity expression if the query

is not separable, wherein the atomically decomposing is repeated for one or

more atomic decompositions of the input selectivity value to produce a plurality of

alternative products that comprise corresponding conditional selectivity

expressions, further comprising;

means for matching a corresponding conditional selectivity

expression for each of the plurality of alternative products with

stored statistics to obtain statistics that can estimate a selectivity

value of the conditional selectivity expression, comprising:

means for compiling a set of candidate statistics that

can be used to estimate the selectivity value of the

conditional selectivity expression;

means for selecting candidate statistics to estimate

the selectivity value of the conditional selectivity expression

based on a selection criteria; and

means for using the statistics to obtain an estimated

selectivity value of the conditional selectivity expression; and

means for combining the estimated selectivity values of the

conditional selectivity expressions corresponding to each

alternative product to determine a third estimated selectivity value

of the query; and

f)   means for storing in memory either the second or third estimated

selectivity value of the query based on whether the query is separable.

46.   (Currently amended) A computer implemented method for approximating

a number of tuples returned by a database query to optimize queries on a

computerized database that comprises a set of predicates that each reference a

set of database tables, the method comprising the steps of:

a)   expressing the query as an input ~~query~~ selectivity value;

b)   determining if the query is separable based on properties of the

input selectivity value;

c)   if the query is separable:

separating the input ~~query~~ selectivity value by separating the

predicates that reference different sets of database tables to form a

product of query selectivity factors that reference different sets of

database tables;

recursively determining a selectivity value for each query

selectivity factor;

combining the selectivity values for each query selectivity

factor to determine a first estimated selectivity value of the query;

d)   if the query is not separable:

atomically decomposing the input ~~query~~ selectivity value to

form a product that comprises a conditional selectivity expression,

wherein the atomically decomposing step is repeated for one or

more atomic decompositions of the input selectivity value to

produce a plurality of alternative products that comprise

corresponding conditional selectivity expressions;

for each of the plurality of alternative products, matching a

corresponding conditional selectivity expression with stored

statistics to obtain statistics that can estimate a selectivity value of

the conditional selectivity expression by:

compiling a set of candidate statistics that can be

used to estimate the selectivity value of the conditional

selectivity expression;

selecting candidate statistics to estimate the

selectivity value of the conditional selectivity expression

based on a selection criteria; and

using the statistics to obtain an estimated selectivity

value of the conditional selectivity expression; and

combining the estimated selectivity values of the conditional

selectivity expressions corresponding to each alternative product to

determine a second estimated selectivity value of the query; and

e)   storing in memory either the first or second estimated selectivity value of the query based on whether the query is separable.

47.   (Original) The method of claim 46 wherein the selection criteria for a candidate statistic is determined by computing a number of independence assumptions that are made when the candidate is used to estimate the selectivity of the conditional selectivity expression and the selection criteria is to select the candidate that results in the least number of independence assumptions.

48.   (Original) The method of claim 46 wherein the selection criteria for a candidate statistic is determined by comparing the candidate statistic with a base statistic over the same column as the candidate statistic and assigning a difference value to the candidate statistic based on a level of difference between the candidate statistic and the base statistic.

49.   (Previously presented) The method of claim 46 wherein the step of compiling a set of candidate statistics is performed by including statistics that are on results of queries having the same tables referenced by the conditional selectivity expression or a subset of the tables referenced by the conditional selectivity expression and the same predicates over the tables referenced in the conditional selectivity expression or a subset of the predicates over the tables referenced in the conditional selectivity expression.

50.   (Previously presented) The method of claim 46 wherein each product

formed in step d) further comprises a query selectivity factor and wherein a

selectivity value for each query selectivity factor is recursively determined.

51.   (Currently amended) The method of claim 46 wherein steps b) – e[[d]]) are

recursively performed until a non-separable query selectivity that can only be

decomposed into a single conditional selectivity expression results.

52.   (Previously presented) The method of claim 46 comprising the step of

associating an error with the second estimated selectivity value that is based on

an accuracy with which the statistic matched with a conditional selectivity

expression can estimate the selectivity of the conditional selectivity expression.

53.   (Previously presented) The method of claim 52 comprising the step of

combining the error associated with each conditional selectivity expression to

obtain an estimated error for the second estimated selectivity value for the query.

54.   (Currently amended) For use with a database system, a computer

readable storage medium having computer executable instructions stored

thereon for performing method steps to approximate a number of tuples returned

by a database query to optimize queries on the database system that comprises

a set of predicates that each reference a set of database tables, the method

comprising the steps of:

a)   expressing the query as an input ~~query~~ selectivity value;

b)   determining if the query is separable based on properties of the

input selectivity value;

c)   if the query is separable:

      separating the input ~~query~~ selectivity value by separating the

predicates that reference different sets of database tables to form a

product of query selectivity factors that reference different sets of

database tables;

      recursively determining a selectivity value for each query

selectivity factor;

      combining the selectivity values for each query selectivity

factor to determine a first estimated selectivity value of the query;

d)   if the query is not separable:

      atomically decomposing the input ~~query~~ selectivity value to

form a product that comprises a conditional selectivity expression,

wherein the atomically decomposing step is repeated for one or

more atomic decompositions of the input selectivity value to

produce a plurality of alternative products that comprise

corresponding conditional selectivity expressions;

      for each of the plurality of alternative products, matching a

corresponding conditional selectivity expression with stored

statistics to obtain statistics that can estimate a selectivity value of

the conditional selectivity expression by:

compiling a set of candidate statistics that can be

used to estimate the selectivity value of the conditional

selectivity expression;

selecting candidate statistics to estimate the

selectivity value of the conditional selectivity expression

based on a selection criteria; and

using the statistics to obtain an estimated selectivity

value of the conditional selectivity expression; and

combining the estimated selectivity values of the conditional

selectivity expressions corresponding to each alternative product to

determine a second estimated selectivity value of the query; and

e)   storing in memory either the first or second estimated selectivity

value of the query based on whether the query is separable.

55.   (Currently amended) The computer readable storage medium of claim 54

wherein the selection criteria for a candidate statistic is determined by computing

a number of independence assumptions that are made when the candidate is

used to estimate the selectivity of the conditional selectivity expression and the

selection criteria is to select the candidate that results in the least number of

independence assumptions.

56.   (Currently amended) The computer readable storage medium of claim 54

wherein the selection criteria for a candidate statistic is determined by comparing

the candidate statistic with a base statistic over the same column as the

candidate statistic and assigning a difference value to the candidate statistic

based on a level of difference between the candidate statistic and the base

statistic.

57.   (Currently amended) The computer readable storage medium of claim 54

wherein the step of compiling a set of candidate statistics is performed by

including statistics that are on results of queries having the same tables

referenced by the conditional selectivity expression or a subset of the tables

referenced by the conditional selectivity expression and the same predicates

over the tables referenced in the conditional selectivity expression or a subset of

the predicates over the tables referenced in the conditional selectivity expression.

58.   (Currently amended) The computer readable storage medium of claim 54

wherein each product formed in step d) further comprises a query selectivity

factor and wherein a selectivity value for each query selectivity factor is

recursively determined.

59.   (Currently amended) The computer readable storage medium of claim 54

wherein steps b) – e[[d]]) are recursively performed until a non-separable query

selectivity that can only be decomposed into a single conditional selectivity

expression results.

60.   (Currently amended) The computer readable storage medium of claim 54

comprising the step of associating an error with the second estimated selectivity

value that is based on an accuracy with which the statistic matched with a

conditional selectivity expression can estimate the selectivity of the conditional

selectivity expression.

61.   (Currently amended) The computer readable storage medium of claim 60

comprising the step of combining the error associated with each conditional

selectivity expression to obtain an estimated error for the second estimated

selectivity value for the query.

Pursuant to MPEP 606.01 the _Title_ is changed to read

--METHOD AND APPARATUS FOR SELECTING CANDIDATE

STATISTICS TO ESTIMATE THE SELECTIVITY VALUE OF THE

CONDITIONAL SELECTIVITY EXPRESSION IN OPTIMIZE QUERIES BASED

ON A SET OF PREDICATES THAT EACH REFERENCE A SET OF

RELATIONAL DATABASE TABLES —

Reasons for allowance

Claims 1-5,8-10,12-14,16-27,30-32,34-36,38-61 are allowed

The present invention is directed to optimizing queries on relational

databases, more specifically, using conditional selectivity expression for

manipulating query plans. A number of tuples returned by a database query

having a set of predicates that each reference a set of database tables can be

approximated. The query is decomposed to form a product of partial conditional

selectivity expressions. The partial conditional selectivity expressions are then

matched with stored statistics on query expressions to obtain estimated partial

conditional selectivity value. The selectivity of the query is then estimated by

combining the obtained conditional selectivity results.

The closet prior art Chaudhuri et al. US Patent No. 5806061 is directed to

cost-based optimization over multimedia repositories, more specifically, cost

based optimization including translating a user defined ranking expression into a

new filter condition, further defining attribute subconditions in the new filter

condition, statistics are also complied in a database which determine the costs to

process various searches and probes over the attributes. The grade can be

estimated over all attributes specified using a set of statistics stored about the

indices. Depending upon how the condition to be used to rank the objects has

been built, the filter condition is processed as a conjuctive expression (AND) or a

disjutive expression (OR) to retrieve a sufficient number of objects and thereby

minimizing the cost of the search [see Abstract, col 3, line 28-45, fig 2].

The closet prior art Lohman et al. US Patent No. 6763359 is directed to
learning from empirical results in query optimization, more specifically, optimizing
queries in a relational database management system by generating a plurality of
query execution plans for the query, providing an execution model of each of the
query execution plans, choosing one of the query execution plans for execution
based on the model associated therewith, and exploiting an empirical
measurement from the execution of the chosen query execution plan to validate
the model associated therewith, by determining whether the model is in error,
and by computing one or mote adjustments to the model to correct the
determined error [see Abstract, col 3, line 20-34].

It is however, noted that the prior art of record either along or in
combination fails to anticipate or render obvious, the recited feature "for each of
the plurality of alternative products, matching a corresponding conditional
selectivity expression with stored statistics to obtain statistics that can estimate a
selectivity value of the conditional selectivity expression *by: compiling a set of
candidate statistics that can be used to estimate the selectivity value of the
conditional selectivity expression; selecting candidate statistics to estimate the
selectivity value of the conditional selectivity expression based on a selection
criteria;"* in claim 1,23, 45-46,54

These features, together with the other limitations of the independent claims are novel and non-obvious over the prior art of record. The dependent claims 2-5,8-10,12-14,16-22,24-27,30-36,3844,47-53,55-61 being definite, enabled by the specification, and further limiting to the independent claims is also allowable.

The newly cited reference issued to Gao et al. US Pub.No. 2005/0071331 is directed to estimating the compilation time of a query optimizer, more specifically, estimating optimization complexity by estimating the number of distinct join plans that will be generated, rather than the number of join sequences. The join enumerator in an optimizer is reused to iterate all the join pairs, but plan generation is bypassed. A small number of differentiating properties are accumulated during enumeration to calculate the number of generated plans for each enumerated sequences, further estimator provides more accurate compilation time estimation [see Abstract, page 3, col 2, 0028].

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Srirama Channavajjala whose telephone number is 571-272-4108. The examiner can normally be reached on Monday-Friday from 8:00 AM to 5:30 PM Eastern Time.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Alam, Hosain, T, can be reached on (571) 272-3978. The fax phone numbers for the organization where the application or proceeding is assigned is 571-273-8300 Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free)

sc
Patent Examiner.
May 4, 2007.

SRIRAMA VENANNAVAJJALA
PRIMARY EXAMINER